AGENCY USE ONLY				
PERMIT NO.: MTG010256	Date Rec'd.: 10/28/13	Amount Rec'd.: $600	Check No.: V#12397	Rec'd By: ks

Montana Department of
ENVIRONMENTAL QUALITY
WATER PROTECTION BUREAU

FORM **NOI**

Notice of Intent (NOI) for Montana Pollution Discharge Elimination System Application for New and Existing Concentrated Animal Feeding Operations

The Application form is to be completed by the owner or operator of a Concentrated Animal Feeding Operation (CAFO) or Aquatic Animal Production Facility. Please read the attached instructions before completing this form. You must print or type legibly; forms that are not legible or are not complete will be returned. You must maintain a copy of the completed application form for your records.

Section A - Application Status *(Check one):*

- ☐ New — No prior application submitted for this site.
- ☐ Resubmitted — Permit Number: MTG _____
- ☒ Renewal — Permit Number: MTG 010256
- ☐ Modification — Permit Number: MTG _____

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Section B - Facility or Site Information (*See instruction sheet.*):

Site Name CROSS FOUR RANCH

Site Location 1562 ROAD 158 ROSEBUD, MT 59347-9607

Nearest City or Town MILES CITY County CUSTER

Latitude 46° 20' 03 N Longitude 106° 08' 10" W

Date Facility began operation? 1968

Is this facility or site located on Indian Lands? ☐ Yes ☒ No

Section C - Applicant (Owner/Operator) Information:

Owner or Operator Name CROSS FOUR RANCH 10/29/13

Mailing Address PO BOX 70

City, State, and Zip Code MILES CITY MT 59301

Phone Number 406-232-4527

Is the person listed above the owner? ☐ Yes ☒ No

Status of Applicant *(Check one)* ☐ Federal ☐ State ☒ Private ☐ Public ☐ Other (specify) _____

245 WPTS

Section D - Existing or Pending Permits, Certifications, or Approvals: ☒ None

☐ MPDES _____ ☐ RCRA _____

☐ PSD (Air Emissions) _____ ☐ Other _____

☐ 404 Permit (dredge & fill) _____ ☐ Other _____

Section E – Standard Industrial Classification (SIC) Codes:

Provide at least one SIC code which best reflects the activity of project described in Section H.			
Code	**A. Primary**	**Code**	**B. Second**
1	211 BEEF CATTLE FEEDLOTS	2	
Code	**C. Third**	**Code**	**D. Fourth**
3		3	

Section F - Facility or Site Contact Person/Position:

Name and Title, or Position Title FRED WACKER, OPER. SHANE REHM MANAGER

Mailing Address POBOX 70

City, State, and Zip Code MILES CITY MT 59301

Phone Number 406/951-3953 406/951-1111

Section G – Receiving Surface Waters(s):

Outfall/Discharge Locations: For each outfall, List latitude and longitude to the nearest second and the name of the receiving waters

Outfall Number	Latitude	Longitude	Receiving Surface Waters
001	46°19'29"N	106°07'10"W	YELLOW STONE RIVER
002			
003			
004			
005			

Map: Attach a topographic map extending one mile beyond the property boundaries or the site activity identified in Section B depicting the facility or activity boundaries, major drainage patterns, and the receiving surface waters, stated above. Also identify the specific location of the production area, and land application area(s).

Is the receiving water on the 303(d) list for nutrients (nitrogen and/or phosphorus) ☐ Yes ☒ No

Section H – Concentration Animal Feeding Operation Characteristics

Waste Production, Storage and Disposal

Animal type	Number in Open Confinement	Number Housed Under Roof
☐ Mature Dairy Cows		
☐ Dairy Heifers		
☐ Veal Calves		
☒ Cattle (not dairy or veal)	9000	
☐ Swine (55 lbs or over)		
☐ Swine (55 lbs or under)		
☐ Horses		
☐ Sheep or Lambs		
☐ Turkeys		
☐ Chickens (broilers)		
☐ Chickens (layers)		
☐ Ducks		
☐ Other (Specify:_____)		
☐ Other (Specify:_____)		
☐ Other (Specify:_____)		

Manure, Litter and/or Wastewater Production and Use.

How much manure, litter, and process wastewater is generated annually by the facility?

Solid (~~tons~~): 1,232,250 C.F Liquid/Slurry (gallons):_____

If land applied, how many acres of land under control of the permit applicant are available to apply the manure, litter, or process wastewater generated from the facility? (Note: Do not include setback distances in available acreage

4000 Acres

How much manure, litter, and process wastewater is transferred to other persons per year? (estimated) Solid (tons): 0 Liquid/Slurry (gallons): 0

Were the containment structures built after February 2006? NO

- ☒ Do the waste containment structures have 10 feet of separation between the pond bottom and any bedrock formations?
- ☒ Do the waste containment structures have 4 feet of separation from the pond bottom and any ground water?
- ☒ Were any of the waste containment structures built within 500 feet of any existing well?

Type of Containment/Storage	Total Capacity	Units (gallons or tons)	Days of Storage
☐ Anaerobic Lagoon			
☐ Storage Pond #1 UPPER C	550,863	CF	
☐ Storage Pond #2 4-C	117,845	CF	
☐ Storage Pond #3 1-6	675,000	CF	
☐ Storage Pond #4 7-9	708,960	CF	
☐ Storage Pond #5			
☐ Above Ground Storage Tank			
☐ Below Ground Storage Tank #1			
☐ Below Ground Storage Tank #2			
☐ Underfloor Pits			
☐ Roofed Storage Shed			
☐ Concrete Pad			
☐ Impervious Soil Pad			
☐ Other (Specify:_____)			
☐ Other (Specify:_____)			

Physical Data for CAFO

Nutrient Management Plan

All Concentrated Animal Feeding Operations seeking permit coverage after July 31, 2007 are required to complete and implement a Nutrient Management (NMP). The NMP must be submitted to the Department using the form provided by the Department (Form NMP). Check the box below that applies and provide the required information. The NMP must be developed in accordance with ARM 17.30.1334 and implemented upon the effective date of permit coverage. (Check One)

☑ Does the facility have an NMP?
Date NMP was developed: 9/26/08

Date NMP was last modified: _____

☐ NMP has not been prepared; provide detailed explanation below

Section I – Supplemental Information

Section J - CERTIFICATION

Permittee Information:

This Form NMP must be completed, signed, and certified as follows:

- For a corporation, by a principal officer of at least the level of vice president;
- For a partnership or sole proprietorship, by a general partner or the proprietor, respectively; or
- For a municipality, state, federal, or other public facility, by either a principal executive officer or ranking elected official.

All Permittees Must Complete the Following Certification:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information; including the possibility of fine and imprisonment for knowing violations. [75-5-633, MCA]

A. Name (Type or Print)	
Fred D. Waeker	
B. Title (Type or Print)	**C. Phone No.**
Operator	406-951-3953
D. Signature	**E. Date Signed**
Fred D. Waeker	10-24-13

The Department will not process this form until all of the requested information is supplied, and the appropriate fees are paid. Return this form (NOI) and the applicable fee to:

Department of Environmental Quality
Water Protection Bureau
PO Box 200901
Helena, MT 59620-0901
(406) 444-3080

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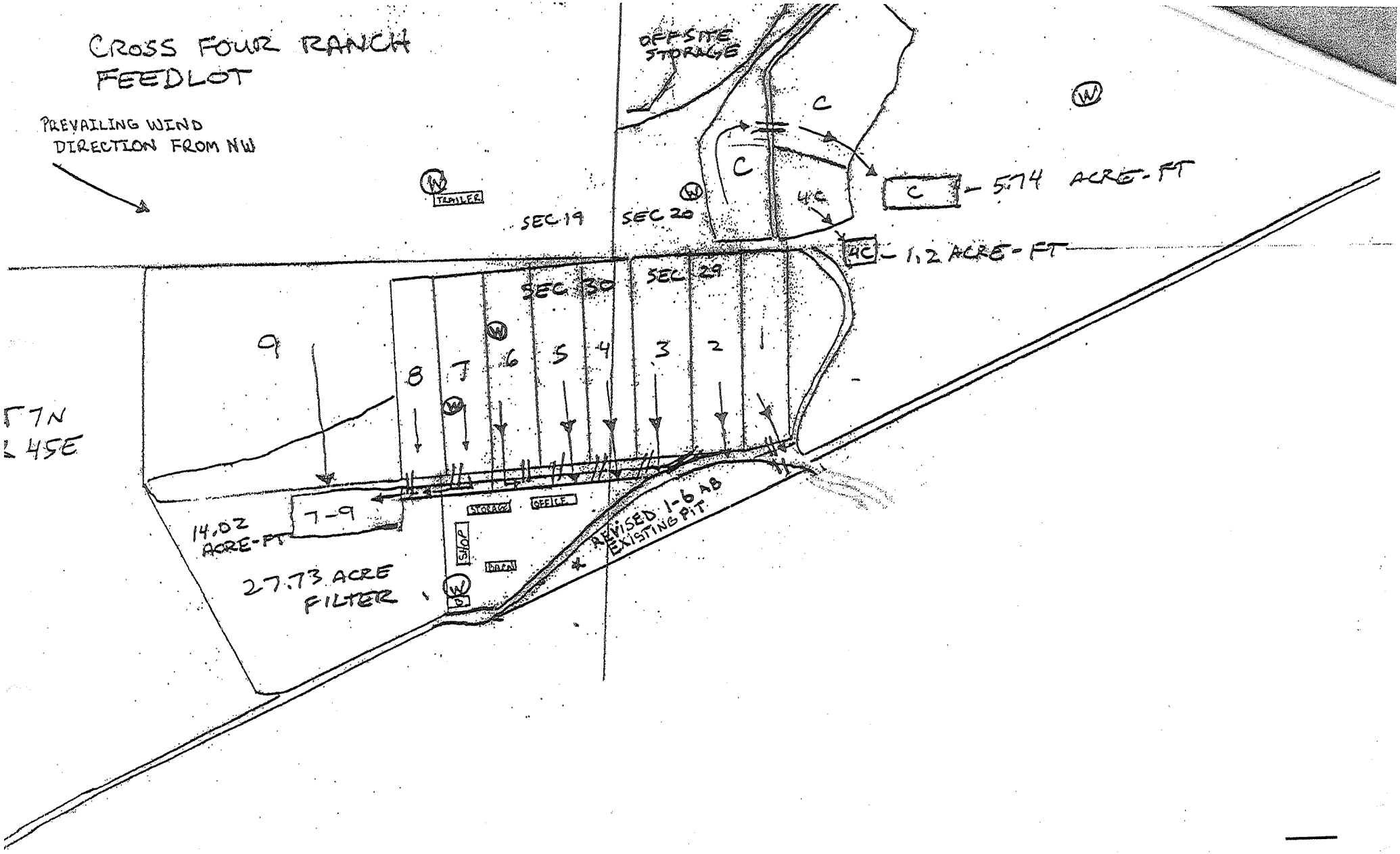
CROSS FOUR RANCH
FEEDLOT
PREVAILING WIND
DIRECTION FROM NW
OFF SITE
STORAGE
C
C
C
- 5.74 ACRE-FT
4C
4C
- 1.2 ACRE-FT
TRAILER
SEC 19
SEC 20
SEC 30
SEC 29
9
8
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6
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4
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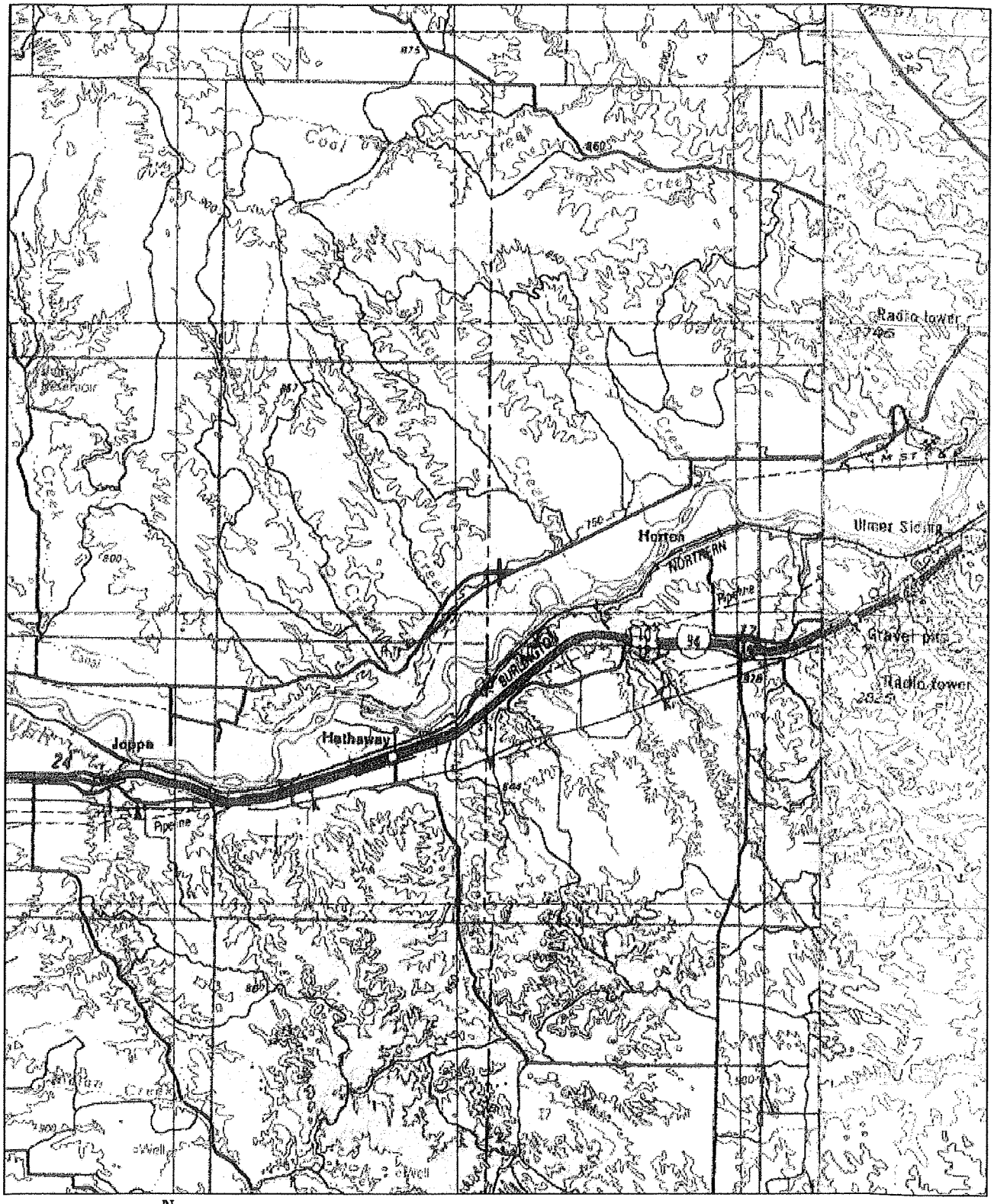
2
1
T7N
L45E
7-9
14.02
ACRE-FT
27.73 ACRE
FILTER
STORAGE
OFFICE
SHOP
BARN
REVISED 1-6 AB
EXISTING PIT

7/19/08


Cool Creek
Radio tower
Horton
NORTHERN
Pipeline
Ulmer Siding
BURLINGTON
Gravel pits
Radio tower
Hathaway
Joppa
24
Pipeline
Well
Well
N
0 4 Mi
0 24000 Ft
Map provided by MyTopo.com


Rd 158
ROSEBUD
CUSTER
CartersvilleRd

AGENCY USE ONLY				
PERMIT NO.:	Date Rec'd.:	Amount Rec'd.:	Check No.:	Rec'd By:
MTG-010256	10/28/13	$600	✓ #12397	bs

Montana Department of
ENVIRONMENTAL QUALITY
WATER PROTECTION BUREAU

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FORM
NMP

Nutrient Management Plan

READ THIS BEFORE COMPLETING FORM: Before completing this form (Form NMP), Concentrated Animal Feeding Operation (CAFO) operators need to read the General Permit, particularly Part IV.A. CAFO operators also need to read the "Instructions For filling out Form NMP," found at the back of this form. Form NMP is intended to help CAFO operators develop a site-specific Nutrient Management Plan, in compliance with Part IV.A of the General Permit and all applicable State rules and statutes. Your Nutrient Management Plan must be maintained at the site as required in Part III of the General Permit. Sections B and C on your Form NMP must state the information exactly the same way as it was stated on the most recently submitted version of your NOI-CAFO. Attach additional pages as necessary, indicating the corresponding section number on this NMP form. The 2013 General Permit, current fee schedule, and related forms are available from the Water Protection Bureau at (406) 444-3080 or http://www.deq.mt.gov/wqinfo/MPDES/CAFO.asp

Section A – NMP Status:

- ☐ New — No prior NMP submitted for this site.
- ☐ Resubmitted — Previous NMP found incomplete.
- ☒ Modification — Change or update to existing NMP.
- ☐ New 2013 — New 2013 version of NMP.

Section B – Facility Information:

Facility Name CROSS FOUR RANCH

Facility Location 1562 ROAD 158

Nearest City of Town ROSEBUD MT 59347 County CUSTER

Section C – Applicant (Owner/Operator Information):

Owner or Operator Name FRED WACKER

Mailing Address PO BOX 70

City, State, and Zip code MILES CITY MT 59301

Facility Phone Number 406-232-4527

Email CROSS4RANCH@RANGEWEB.NET

Section D – NMP Minimum Elements:

1. Livestock Statistics		
Animal Type and number of animals	**# of Days on Site (per year)**	**Annual Manure Production (tons, cu. yds. or gal**
1. CATTLE (NOT DAIRY OR VEAL)	240	4510 TON
2.		
3.		
4.		
5.		
6.		
7.		
8.		

Method used for estimating annual manure production:

SEE ATTACHMENT A

2. Manure Handling

a. Describe Manure handling at the facility:

ONCE A YEAR, CAFO IS CLEANED AND MANURE IS SPREAD ON 4,200 ACRES OF AVAILABLE FARM LAND.

b. Frequency of Manure Removal from confinement areas: ONCE PER YEAR

c. Is this manure temporarily stored in any location other than the confinement area? ☒ Yes ☐ No
If so then how and where?

- STORED OCCASIONALLY ON HARD PACKED GROUND WITHIN THE WATER SHED OF CAFO
- PENS ARE SCRAPED INTO THE MIDDLE

d. Is manure stored on impervious surface? ☐ Yes ☒ No
If yes, describe type and characteristics of this surface:

3. Waste Control Structures

Waste Control Structures (name/type)	Length (ft.)	Width (ft.)	Depth (ft.)	Volume (cubic ft. or gallons)	Number of days of storage
1. PENS 7,8,9	730	121	8	708,960	
2. PENS 1,2,3,4,5,6	750	223	4	675,000	
3. UPPER C MAIN	263	235	5.5	406,707	
4. UPPER C MIDDLE	266	25	5	69,625	
5. UPPER C LOWER	242	154	2	74,536	
6. PEN 4C	266	25	7	117,845	
7.					
8.					
9.					
10.					
11.					
12.					

What is the 24 hr. 25 yr. storm event at this facility 2.7"

Production area: 156.7 **acres. Type of lot (dirt or paved):** DIRT

Area contributing drainage form outside CAFO that enters confinement areas and waste storage, conveyance, or treatment structures: 0 **acres.**

What is the annual precipitation during the critical storage period 6.3"

How much freeboard do the pond(s) have 2'

4. Disposal of Dead Animals.

Describe how dead animals are disposed of at this facility:

DEAD ANIMALS ARE HAULED AS SOON AS FOUND TO BURIAL LOCATION, WHICH IS ONE MILE FROM CAFO. OPERATION.

5. Clean Water Diversion Practices

Describe how clean water is diverted from production area:

BERMS AND NATURAL TOPOGRAPHY

6. Prohibiting Animals and Wastes from Contact with State Waters
Describe how animals and wastes are prohibited from direct contact with state waters:

FENCE, PITS, FILTER STRIPS

Describe how Chemicals and other contaminants are handled on-site:

FARMING CHEMICAL APPLICATIONS ARE CONTRACTED OUT.

7. Best Management Practice (BMPS)

Describe in detail all temporary, permanent and structural BMPS which will be used to control runoff of pollutants from facility's production area. Indicate the location of these measures. If BMPS are not installed include a schedule for implementation of each of these measures. Examples of BMP measures could include but are not limited to: constructing ditches, terraces,, and waterways above and open lot to divert clean water run on; installing gutters, downspouts and buried conduits to divert roof drainage; providing more roofed area: decreasing open lot surface area; repairing of adjusting water systems to minimize water wastage; using practical amounts of water for cooling purposes; recycling water if practical and applicable.
Production Area BMP's

- DITCHES ARE USED TO DIVERT WATER
- NO WATER IS USED FOR COOLING PURPOSES
- ALL WATERERS ARE INSPECTED DAILY AND MAINTAINED

Describe in detail all temporary, permanent and structural Best Management Practices (BMPs) which will be used to control runoff of pollutants from facility's land production area. Indicate the location of these practices. If not already in use, include a schedule for implementation of each of these measures. Attached details and specifications may be used to supplement this description. Examples of BMP measures could include but are not limited to: maintaining setbacks from surface waters for manure applications; managing irrigation practices to prevent ponding of wastewater on land application sites;

never spray irrigating waste on to frozen ground: consulting with the Department prior to applying any liquid waste to frozen or snow-covered ground; applying wastes at agronomic rates.

Land Application BMP's - FLOOD CONTROL DIKE ALONG LENGTH OF THE RIVER
- DISPOSE OF NO LIQUID WASTES
- SOIL TESTING SO THE APPROPRIATE APPLICATION LEVEL OF NUTRIENTS BASED UPON REALISTIC CROP YIELDS
- IN MANY CASES, PIVOT SPRINKLERS ARE USED TO IRRIGATE WHICH GREATLY REDUCES WASTE WATER

Buffers	☒ Yes ☐ No	**Conservation Tillage**	☐ Yes ☒ No
Constructed Wetlands	☐ Yes ☒ No	**Grass Filter**	☒ Yes ☐ No
Infiltration Field	☐ Yes ☒ No	**Residue Management**	☒ Yes ☐ No
Set backs	☒ Yes ☐ No	**Terrace**	☒ Yes ☐ No

Other examples

8. Implementation, Operation, Maintenance and Record Keeping – Guidance

The permittee is required to develop guidance addressing implementation of NMP, proper operation and maintenance of the facility, and record keeping as described in Part 2 of the permit.

Has a guidance document been developed for the facility? ☒ Yes ☐ No

Certify the document address the following requirements:

Implementation of the NMP:	☒ Yes ☐ No
Facility operation and maintenance:	☒ Yes ☐ No
Record keeping and reporting	☒ Yes ☐ No
Sample collection and analysis:	☒ Yes ☐ No
Manure transfer	☒ Yes ☐ No

Provide name, date and location of most recent documentation:

CROSS FOUR RANCH CODE OF CARE
ATTACHMENT B

If your answer to any of the above question is no, provide explanation:

Section E – Land Application

Will manure be land applied to land either owned, rented, or leased by the owner or operator of the facility?

☒ Yes If yes, then the information requested in Section E must be provided.

☐ No If no, then provide an explanation of how animal waste at this facility are managed.

Photos and/or Maps

Attach an aerial photograph or map of the site where manure is to be applied. (Use multiple photos/maps if necessary to show required details.) The photo(s)/map(s) must be printed on no larger than an 11"X 17" piece of paper, and must clearly identify the following items:

- Individual field boundaries for all planned land application areas
- A name, number, letter or other means of identifying each individual land application field
- The location of any downgradient surface waters.
- The location of any downgradient open tile line intake structures
- The location of any downgradient sinkholes
- The location of any downgradient agricultural well heads
- The location of all conduits to surface waters
- The specific manure/waste handling or nutrient management restrictions associated with each land application field
- The soil type(s) present and their locations within the individual land application field(s)
- The location of buffers and setbacks around state surface waters, well heads, etc.

ATTACHMENT C

Land Application Equipment Calibration

Describe the type of equipment used to land apply wastes and the calibration procedures:

TRUCK WITH SPREADER ON BACK WILL BE CALIBRATED ACCORDING TO ARM 17.30.1334

Manure Sampling and Analysis Procedures

A representative manure sample will be analyzed a minimum of once annually for Total Nitrogen, and Total Phosphorus. Analysis results will be reported in lbs/ton or lbs/1,000 gal. Results of these analyses will be used in determining rates for manure, litter, and process wastewater.

Manure Sample collection will occur according to ARM 17.30.1334 YES

Other (describe)

Soil Sampling and Analysis Procedures

Representative soil (composite) samples from the top 6 inches layer of soil for each field where manure will be applied must be analyzed for phosphorus content at least once every three years. Analyses will be conducted by a qualified laboratory, using the Olsen P test. Results will be reported in parts per million (ppm) and will be used in determining application rates for manure, litter, and process wastewater

Soil samples collection will occur according the methods in ARM 17.30.1334 YES

Other (describe)

Phosphorus Risk Assessment

The permittee shall access the risk of phosphorus contamination of state waters. An assessment shall be conducted for each field, under the control of the operator, to which manure, litter or process wastewater will or

may be applied. If a new field is added in the future, then the permittee must submit a revised (modified) NMP. The permittee has the option of using Method A or Method B (below) to complete the assessment. Copies of all tables and calculations used to complete the assessments, as well as the results of the assessments, shall be submitted to the Department and copies shall be maintained on-site at the facility and available for Departmental review. The results of the assessments shall be used to determine the appropriate basis for land application of wastes from the facility.

Method Used

Indicate which method will be used to determine phosphorus application:

(Method A – Representative Soil Sample)

Method B – Phosphorus Index

Method A – Representative Soil Sample

a. Obtain one or more representative soil sample(s) from the field per 17.30.1334
b. Have the sample analyzed for Phosphorus by a qualified lab. The "Olsen P test" must be used for the analysis, and the result must be reported in parts per million (ppm)
c. Using the results of the Olsen P test, determine application basis according to the Table below.

Soil Test

Olsen P Soil Test Results (ppm)	Application Basis
<25.0	Nitrogen Needs of Crop
25.1 - 100.0	Phosphorus Needs of Crop
100.0 – 150.0	Phosphorus Needs up to Crop Removal Rate
>150.0	No Application allowed

Method B – Phosphorus Index

a. Complete a phosphorus Index according to the crop grown on each field. Complete table in Appendix A to calculate phosphorus index. For information on filling out specific sections in Appendix A, please refer to the method as described in Natural Resource Conservation Service (NRCS), Agronomy Technical Note MT-77 (rev3), January 2006.
b. Using the calculated Total Phosphorus Index Value, assign the overall site/field vulnerability to phosphorus loss according to the table below.

Total Phosphorus

Total Phosphorus Index Value	Site Vulnerability to Phosphorus Loss
<11	Low
11-21	Medium
22-43	High
>43	Very High

c. Using the calculated Site Vulnerability to Phosphorus Loss, determine the appropriate application basis according to the table below.

Site Vulnerability to Phosphorus Loss	Application Basis
Low	Nitrogen Needs
Medium	Nitrogen Needs
High	Phosphorus Need Up to Crop Removal
Very High	Phosphorus Crop Removal or No Application

The applicant has 2 ways in which to report how manure or process wastewater application rates can be reported to DEQ.

1. **Linear Approach**. Expresses rates of application as pounds of nitrogen and phosphorus. CAFOs selecting the linear approach to address rates of application must include in the NMP submitted to the permitting authority the following information for each crop, field, and year covered by the NMP, which will be used by the permitting authority to establish site-specific permit terms:
- The maximum application rate (pounds/acre/year of nitrogen and phosphorus) from manure, litter, and process wastewater.
- The outcome of the field-specific assessment of the potential for nitrogen and phosphorus transport from each field. [If a state does not have an N transport risk assessment, the NMP must document any basis for assuming that nitrogen will be fully used by crops.] The CAFO must specify any conservation practices used in calculating the risk rating.
- The crops to be planted or any other uses of a field such as pasture or fallow fields.
- The realistic annual yield goal for each crop or use identified for each field.
- The nitrogen and phosphorus recommendations from in ARM 17.30.1334 (technical standard) for each crop or use identified for each field.
- Credits for all residual nitrogen in each field that will be plant-available.
- Consideration of multi-year phosphorus application. For any field where nutrients are applied at a rate based on the crop phosphorus requirement, the NMP must account for single-year nutrient applications that supply more than the crop's annual phosphorus requirement.
- All other additions of plant available nitrogen and phosphorus (i.e., from sources other than manure, litter, or process wastewater or credits for residual nitrogen).
- The form and source of manure, litter, and process wastewater to be land-applied.
- The timing and method of land application. The NMP also must include storage capacities needed to ensure adequate storage that accommodates the timing indicated.
- The methodology that will be used to account for the amount of nitrogen and phosphorus in the manure, litter, and wastewater to be applied.
- Any other factors necessary to determine the maximum application rate identified in accordance with this Linear Approach.

2. **Narrative Rate Approach**. Expresses a narrative rate of application that results in the amount, in tons or gallons, of manure, litter, and process wastewater to be land applied. CAFOs selecting the narrative rate approach to address rates of application must include in the NMP submitted to the permitting authority the following information for each crop, field, and year covered by the NMP, which will be used by the permitting authority to establish site-specific permit terms:
- The maximum amounts of nitrogen and phosphorus that will be derived from all sources of nutrients (pounds/acre for each crop and field).
- The outcome of the field-specific assessment of the potential for nitrogen and phosphorus transport from each field. The CAFO must specify any conservation practices used in calculating the risk rating.
- The crops to be planted in each field or any other uses of a field such as pasture or fallow fields, including alternative crops if applicable. Any alternative crops included in the NMP must be listed by field, in addition to the crops identified in the planned crop rotation for that field.
- The realistic annual yield goal for each crop or use identified for each field for each year, including any alternative crops identified.
- The nitrogen and phosphorus recommendations from ***[the permitting authority to specify acceptable sources]*** for each crop or use identified for each field, including any alternative crops identified.
- The methodology (including formulas, sources of data, protocols for making determination, etc.) and actual data that will be used to account for: (1) the results of soil tests required by Parts II.A.4.b and III.A.3.g of this

permit, (2) credits for all nitrogen in the field that will be plant- available, (3) the amount of nitrogen and phosphorus in the manure, litter, and process wastewater to be applied, (4) consideration of multi-year phosphorus application (for any field where nutrients are applied at a rate based on the crop phosphorus requirement, the methodology must account for single-year nutrient applications that supply more than the crop's annual phosphorus requirement), (5) all other additions of plant available nitrogen and phosphorus to the field (i.e., from sources other than manure, litter, or process wastewater or credits for residual nitrogen), (6) timing and method of land application, and (7) volatilization of nitrogen and mineralization of organic nitrogen.
• Any other factors necessary to determine the amounts of nitrogen and phosphorus to be applied in accordance with the Narrative Rate Approach.
• NMPs using the Narrative Rate Approach must also include the following projections, which will not be used by the permitting authority in establishing site-specific permit terms:
i. Planned crop rotations for each field for the period of permit coverage.
ii. Projected amount of manure, litter, or process wastewater to be applied.
iii. Projected credits for all nitrogen in the field that will be plant-available.
iv. Consideration of multi-year phosphorus application.
v. Accounting for other additions of plant-available nitrogen and phosphorus to the field.
vi. The predicted form, source, and method of application of manure, litter, and process wastewater for each crop

• If the receiving water is on the 303(d) list for nutrients then the narrative rate approach must be used.

a. For the Linear Approach the permittee will complete the Nutrient Budget Worksheet, below, for the next 5 years to which manure or process waste water is or may be applied. A copy of each Nutrient Budget Worksheet will be maintained on site, and a copy will be submitted to the Department.

Nutrient Budget Worksheet

Field identification:		Year:		Crop: Alfalfa	
Expected Crop Yield: 6 ton					
Phosphorus index results or Phosphorus application from soil test:					
Method of Application: Truck spreader					
When will application occur:					
Nutrient Budget			Nitrogen-based Application	Phosphorus-based Application	Source of information
1		Crop Nutrient Needs, lbs/acre		30	EB 161
2	(-)	Credits from previous legume crops, lbs/ac		—	DEQ website
3	(-)	Residuals from past manure production lbs/acre		—	DEQ website
4	(-)	Nutrients supplied by commercial fertilizer and Biosolids, lbs/acre		—	producer
5	(-)	Nutrients supplied in irrigation water, lbs/acre		—	producer
6		**= Additional Nutrients Needed, lbs/acre**		30	
7		Total Nitrogen and Phosphorus in manure, lbs/ton or lbs/1000 gal (from manure test)	12.9 lbs/ton	5 lbs/ton	lab test results
8	(x)	Nutrient Availability factor, for Phosphorus based application use 1.0	.5	1	DEQ website
9		**= Available Nutrients in Manure, lbs/ton or lbs/1000 gal**	6.45 lbs/ton	5 lbs/ton	
10		Additional Nutrients needed, lbs/acre (calculated above)		30	
11	(/)	Available Nutrients in Manure, lbs/ton or lbs/1000 gal (calculated above)		5	
12		**= Manure Application Rate, tons/acre or 1000 gal/acre**		6 tons/Acre	

Comments:

Avg Olson P for fields < 25 ppm = 13.12

Nutrient Budget Worksheet

Field identification:		Year:		Crop: Soybeans	
Expected Crop Yield: 70 bu					
Phosphorus index results or Phosphorus application from soil test:					
Method of Application: truck spreader					
When will application occur:					
Nutrient Budget			Nitrogen-based Application	Phosphorus-based Application	Source of information
1		Crop Nutrient Needs, lbs/acre	—	20	EB 161
2	(-)	Credits from previous legume crops, lbs/ac			DEQ website
3	(-)	Residuals from past manure production lbs/acre			DEQ website
4	(-)	Nutrients supplied by commercial fertilizer and Biosolids, lbs/acre			producer
5	(-)	Nutrients supplied in irrigation water, lbs/acre			producer
6		**= Additional Nutrients Needed, lbs/acre**			
7		Total Nitrogen and Phosphorus in manure, lbs/ton or lbs/1000 gal (from manure test)	12.9 lbs/ton	5 lbs/ton	lab test results
8	(x)	Nutrient Availability factor, for Phosphorus based application use 1.0	.5	1	DEQ website
9		**= Available Nutrients in Manure, lbs/ton or lbs/1000 gal**	6.45 lbs/ton	5 lbs/ton	
10		Additional Nutrients needed, lbs/acre (calculated above)		20	
11	(/)	Available Nutrients in Manure, lbs/ton or lbs/1000 gal (calculated above)		5	
12		**= Manure Application Rate, tons/acre or 1000 gal/acre**		4 tons/Acre	

Comments:

Avg Olsen P for fields < 25 ppm = 13.12.

Nutrient Budget Worksheet

Field identification:	Year:	Crop: Spring wheat
Expected Crop Yield: 95 bu		
Phosphorus index results or Phosphorus application from soil test:		
Method of Application: truck spreader		
When will application occur:		

		Nutrient Budget	Nitrogen-based Application	Phosphorus-based Application	Source of information
1		Crop Nutrient Needs, lbs/acre	313	27.5	EB 161
2	(-)	Credits from previous legume crops, lbs/ac	60	—	DEQ website
3	(-)	Residuals from past manure production lbs/acre	.4 X 11.3 tons/acre X .5 = 29.2	12.9 lbs/ton —	DEQ website lab test results
4	(-)	Nutrients supplied by commercial fertilizer and Biosolids, lbs/acre	126 lbs	—	producer
5	(-)	Nutrients supplied in irrigation water, lbs/acre	—	—	producer
6		**= Additional Nutrients Needed, lbs/acre**	97.8	27.5	
7		Total Nitrogen and Phosphorus in manure, lbs/ton or lbs/1000 gal (from manure test)	12.9 lbs/ton	5 lbs/ton	lab test results
8	(x)	Nutrient Availability factor, for Phosphorus based application use 1.0	.5	1	DEQ website
9		**= Available Nutrients in Manure, lbs/ton or lbs/1000 gal**	6.45 lbs/ton	5 lbs/ton	
10		Additional Nutrients needed, lbs/acre (calculated above)	97.8	27.5	
11	(/)	Available Nutrients in Manure, lbs/ton or lbs/1000 gal (calculated above)	6.45	5	
12		**= Manure Application Rate, tons/acre or 1000 gal/acre**	15.2 tons/Acre	5.5 tons/Acre	

Comments:

Avg Olsen P for fields < 25 ppm = 13.2

Nutrient Budget Worksheet

Field identification:		Year:		Crop: Grain Corn	
Expected Crop Yield: 200 bu					
Phosphorus index results or Phosphorus application from soil test:					
Method of Application: Truck spreader					
When will application occur:					
Nutrient Budget			Nitrogen-based Application	Phosphorus-based Application	Source of information
1		Crop Nutrient Needs, lbs/acre	240	35	EB 161
2	(-)	Credits from previous legume crops, lbs/ac	60	—	DEQ Website
3	(-)	Residuals from past manure production lbs/acre	.9 X 15ton x 12.9 lbs/ton X.5 = 38.7	—	DEQ Website lab test results
4	(-)	Nutrients supplied by commercial fertilizer and Biosolids, lbs/acre	98.5 lbs	—	producer
5	(-)	Nutrients supplied in irrigation water, lbs/acre	0	—	producer
6		**= Additional Nutrients Needed, lbs/acre**	42.8 lbs/Ac	35	
7		Total Nitrogen and Phosphorus in manure, lbs/ton or lbs/1000 gal (from manure test)	12.9 lbs/ton	5 lbs/ton	lab test results
8	(x)	Nutrient Availability factor, for Phosphorus based application use 1.0	.5	1	DEQ Website
9		**= Available Nutrients in Manure, lbs/ton or lbs/1000 gal**	6.45 lbs/ton	5 lbs/ton	
10		Additional Nutrients needed, lbs/acre (calculated above)	42.8	35	
11	(/)	Available Nutrients in Manure, lbs/ton or lbs/1000 gal (calculated above)	6.45	5	
12		**= Manure Application Rate, tons/acre or 1000 gal/acre**	6.6 tons/Acre	7 tons/Acre	

Comments:

Avg olsen P for fields < 25 ppm = 13.2

Nutrient Budget Worksheet

Field identification:		Year:		Crop: Silage Corn	
Expected Crop Yield: 30 ton					
Phosphorus index results or Phosphorus application from soil test:					
Method of Application: Truck spreader					
When will application occur:					
Nutrient Budget			Nitrogen-based Application	Phosphorus-based Application	Source of information
1		Crop Nutrient Needs, lbs/acre	250	32.5	EB161
2	(-)	Credits from previous legume crops, lbs/ac	60	—	DEQ website
3	(-)	Residuals from past manure production lbs/acre	.4 x 15 ton x 12.9 lbs/ton x.5 loss = 38.7	—	DEQ website lab test results
4	(-)	Nutrients supplied by commercial fertilizer and Biosolids, lbs/acre	98.5 lbs	—	producer
5	(-)	Nutrients supplied in irrigation water, lbs/acre	0	—	producer
6		**= Additional Nutrients Needed, lbs/acre**	52.8	32.5	
7		Total Nitrogen and Phosphorus in manure, lbs/ton or lbs/1000 gal (from manure test)	12.9 lbs/ton	5 lbs/ton	lab test results
8	(x)	Nutrient Availability factor, for Phosphorus based application use 1.0	x.5	1	DEQ website
9		**= Available Nutrients in Manure, lbs/ton or lbs/1000 gal**	6.45 lbs/ton	5 lbs/ton	
10		Additional Nutrients needed, lbs/acre (calculated above)	52.8	32.5	
11	(/)	Available Nutrients in Manure, lbs/ton or lbs/1000 gal (calculated above)	6.45	5	
12		**= Manure Application Rate, tons/acre or 1000 gal/acre**	8.2 tons/Acre	6.5 tons/Acre	

Comments:

Avg 0 ppm P for fields < 25 ppm = 13.2

Section F - CERTIFICATION

Permittee Information: This form must be completed, signed, and certified as follows:

- For a corporation, by a principal officer of at least the level of vice president;
- For a partnership or sole proprietorship, by a general partner or the proprietor, respectively; or
- For a municipality, state, federal, or other public facility, by either a principal executive officer or ranking elected official.

All Permittees Must Complete the Following Certification:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information; including the possibility of fine and imprisonment for knowing violations. [75-5-633, MCA]

A. Name (Type or Print)	
Fred D. Wacker	
B. Title (Type or Print)	**C. Phone No.**
Operator	406-951-3953
D. Signature	**E. Date Signed**
Fred D. Wacker	10-24-13

The Department will not process this form until all of the requested information is supplied, and the appropriate fees are paid. Return this form and the applicable fee to:

Department of Environmental Quality
Water Protection Bureau
PO Box 200901
Helena, MT 59620-0901
(406) 444-3080

RECEIVED
OCT 28 2013
DEQ/WPB
PERMITTING & COMPLIANCE DIV.

ATTACHMENT A

NAME: Cross Four Ranch
ADDRESS: Miles City, Montana

Amount of Manure Produced

This worksheet estimates the weight of solid manure produced per year

Type of Livestock:	Steers		Heifers	
Number of animals:	4,500	head	4500	head
Time in the lot:	240	Days	240	Days
Average animal Wt:	600	pounds	600	pounds
Lbs wet manure/day	36.00	pounds	36.00	pounds
% Dry Matter	11.60	%	11.60	%
Lbs Dry Matter	4.18	pounds	4.18	pounds
Lbs Dry Manure/hd/yr	1,002.24	pounds	1,002.24	pounds
Total Lbs/yr	4,510,080.00	pounds	4,510,080.00	pounds
Tons Dry Manure/yr	2,255.04	Ton	2,255.04	Ton

TOTAL TONS 4,510.08 Ton

Estimating manure composition & crop nutrient needs

1. Manure composition lb/ton raw waste

NOTE: It is most accurate to have manure composition determined by lab analysis.

Book value estimates are used in absence of manure analysis

Total N	21.00	lbs/ton
Ammonium N	7.00	lbs/ton
P2O5	14.00	lbs/ton
K2O	23.00	lbs/ton

2. Soil information (from soil test)

Texture	Sandy Loam	
Soil pH	8	
Available P	9	ppm
Available K	196	ppm
Pounds/ac of N in soil	50	lbs/ac

3. Nutrient needs of crop

Crops to be grown: 27 ton Corn Silage, 5 ton alfalfa, 90 bushel wheat

Rates applied based on soil test:

		Corn	Alfalfa	Wheat
Nitrogen	lbs/ac	193	0	247
P2O5	lbs/ac	46	66	34
K2O	lbs/ac	60	95	40

4. Amount of organic N in manure per ton:

lb total N – (lb ammonium N + lb nitrate N) = lb organic N

21.00	lbs total N
7.00	lbs Ammonium N
14.00	lbs organic N

5. Amount lb organic N/ton x mineralization factor* = available organic N/ton

14.00	
0.35	mineralization factor (solid without bedding)
4.90	Available organic N/ton available first year

6. Amount Surface application (assumes 1/3 of ammonium N lost by volatilization)

Available organic N + (Ammonium N x 0.66) + Nitrate N = lb plant-available N/ton

4.90	Available orgaic N/ton
4.62	Ammonium N times 0.66
9.52	lbs plant-availble N/ton

7. Annual manure applications if based on amount of N required by crop:

	Corn	Alafalfa	Wheat
Pounds of Nitrogen needed	193.00	0.00	247.00
Available N per ton	9.52	9.52	9.52
Tons needed per acre to meet crop N needs	20.27	0.00	26.95
Acres that can be fertilized with available manure	222	0	174

8. Annual manure application if based on P2O5 crop needs

Tons of manure per acre to meet crop needs	8.29	4.71	2.43
Acres that can be fertilized with available manure	373	957	1857

9. Annual manure application if based on K20 crop needs

Tons of manure per acre to meet crop needs	2.61	4.18	1.74
Acres that can be fertilized with available manure	1729	1092	2598

Acres Available for Feedlot Use:	
Corn for Silage	1500
Alafalfa Hay	2400
Irrigated Wheat	300

ATTACHMEN. B

2010-2011

Code of Cattle Care Handbook

-Provide necessary food, water and care to protect the health and well-being of animals.
-Provide disease prevention practices to protect herd health, including access to veterinary care.
-Provide facilities that allow safe, humane, and efficient movement and/ or restraint of cattle.
-Make timely observations of cattle to ensure basic needs are being met.
-Minimize stress when transporting cattle.
-Keep updated on advancements and changes in the industry to make decisions based upon sound production practices and consideration for animal well-being.
-Persons who willfully mistreat animals will not be tolerated.

1.0 Facility Upkeep and Maintenance Procedures

Objective: To ensure upkeep and safety of the entire facility.

1.1 General Operating Procedures

1. Dispose of trash and other debris in trash receptacles located throughout the facility.
2. Keep all buildings clean.
3. Return supplies or equipment to their proper storage location.
4. First aid kits will be available and accessible.
5. Phone numbers for local emergency, management, and veterinarians should be posted and accessible.

2.0 Biosecurity Procedures

Objective: To reduce the chances of infectious diseases being carried onto the premises by both people and animals, and to reduce the spread of these diseases if they are present on the farm.

2.1 Prevent the Introduction of Infected Animals

1. If possible, bring in animals from known and respected sources.
2. If possible, avoid purchasing animals that have been co-mingled with animals of another herd.
3. Only use known and respectable cattle transporting services.
4. For hired transporters, ensure that they start out with a clean truck.
5. Do not allow outside truck cleaning on the premises.

2.2 Prevent the Introduction of Infectious Diseases

1. Visitors should not be allowed in animal holding facilities without employee or management approval.
2. Upon arrival, visitors should check in at the ranch headquarters or with management.

2.3 Increase the Resistance of Animals to Infectious Diseases

1. Reduce stress on animals caused by diseases through proper immunization. A proper vaccination and immunization program should be implemented according to veterinary recommendations.
2. Reduce stress on animals caused by poor nutrition, uncomfortable housing, or poor air quality through proper management.

2.4 Decrease Exposure to Infectious Diseases

1. Isolate sick animals, especially animals with unfamiliar symptoms or those that don't respond to standard treatment.
2. Remove dead animals and dispose of them properly.

3. Minimize manure contamination of hair coat, feed, and water by keeping facilities, feeders, and waterers clean.

3.0 Cattle Handling Procedures

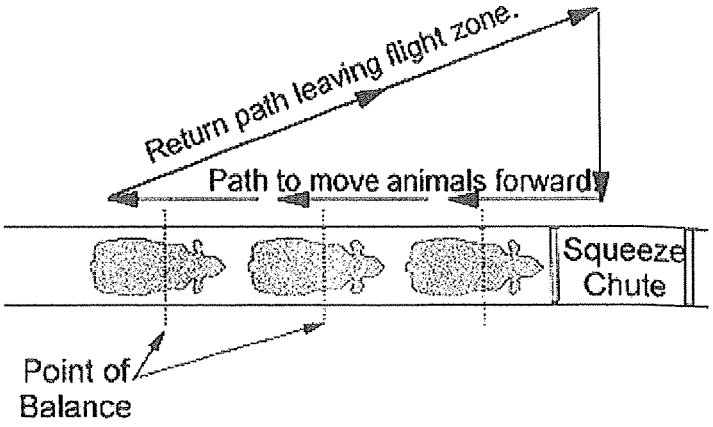
Objective: To ensure all cattle are handled appropriately and treated humanely at all times to protect the animal as well as the handler. To avoid wild behavior in animals, and to minimize equipment breakage and employee injuries.

3.1 Cattle Working and Handling

1. Prior to working or moving cattle, inspect the fences, chutes, corrals, and working facility to ensure proper care and ease of handling.
2. Make all necessary repairs, including removing protruding bolts, nails, etc.
3. Handle cattle gently and humanely at all times to avoid injury (i.e. bruises) or extra stress to the animals and injury to handlers. Refer to Point of Balance Diagram.
4. Gather cattle from pastures quietly and in small groups.
5. Before moving cattle through the handling facilities, ensure that all chains are tied up and trash is removed to prevent balking.
6. Keep cattle calm in the alley, so that they will be calm coming into the chute.
7. Use paddle sticks to move cattle through the handling facility.
8. Refrain from yelling, screaming, or making sudden movements near cattle.
9. The only time a hotshot should be used is before the cattle enter the squeeze chute for the safety and welfare of the animal. It should be used if cattle will not move and after all other techniques have been employed. It should never be used excessively.
10. When not in use, place the hotshot in a stationary place near the processing area.
11. Remember that the goal is to have cattle walk into the squeeze chute and walk out.

Point of Balance Diagram

Handler movement pattern to keep cattle moving into a squeeze chute



4.0 Receiving and Administering Cattle Health Products Procedures

Objective: To ensure the proper handling, storage, and administration of all cattle health products, and to ensure proper record keeping for all treatments.

4.1 Receiving Health Products

1. Purchase and use only FDA/USDA/EPA approved health products for treating cattle.
2. Store the products according to label directions in the refrigerator or in a clean dry cabinet . Do not store food in refrigerators that are used for animal medications.

4.2 Treatment Procedures

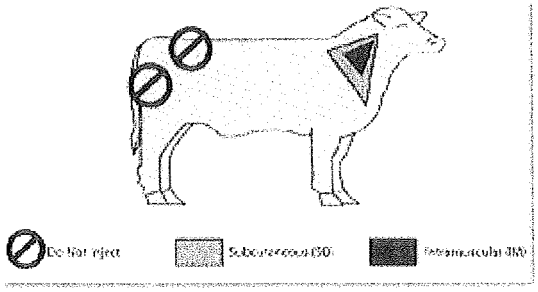
4.2A Before Administering the Product

1. Get authorization from management before administering any products.
2. Read label directions before a medication is used to ensure that the proper use, dosage, route of administration, frequency and timing of administration, withdrawal periods, and negative side effects are observed.
3. For extra label drug use, consult a veterinarian, and follow withdrawal times set by the veterinarian.
4. Check expiration dates on all products and check all products for contamination (possible discoloration or thickening) before use.
5. Dispose of outdated and contaminated products in normal refuse containers.
6. Read the label directions to determine how long a reconstituted vaccine can remain mixed before it is used. NOTE: Most modified live vaccines must be reconstituted by adding sterile water to a dehydrated "cake" in a separate sterile vial. Once the water is added, the viral organisms are fragile and will be "live" only for a short time. As a rule of thumb, only reconstitute enough vaccine to be used in 45-60 minutes.
7. Ensure that needles and syringes are clean and not cracked or broken.
8. Properly restrain the animal for all procedures. Refer to 3.0 for proper restraint technique.
9. If the injection site is dirty, clean the site with water only before giving injections. Use a damp rag to rid the site of manure and/or mud.

4.2B Administering the Product

1. Administer products strictly according to the label.
2. Give all intramuscular (IM) and subcutaneous (SQ) injections in the neck; NEVER in the top sirloin (rump) or hindquarter.
3. When possible, use SQ, intravenous (IV), and oral products instead of IM products.
4. Use the tented method for SQ injections (lift the skin and slide the needle into the space created between the hide and the muscle layers).
5. Do not administer more than 10 cc in any one injection site location. Space multiple injections 2-3 inches apart.
6. Use separate, labeled syringes for each product.
7. Never put a used injection needle back into a drug bottle.
8. Clean syringes after use and before using a different drug in the same syringe. Do not use disinfectants to clean syringes for modified-live viral vaccine.
9. For processing cattle, change needles before refilling vaccine gun (every 10-15 uses), or when bent, dull, burred, or dirty.

Proper Injection Sites:



4.2C After Administering the Product

1. Return all remaining products back to their proper storage location.
2. Dispose of any unused, reconstituted modified live vaccines.
3. Return any unused needles back to the needle storage container.
4. Dispose of used sharps (needles and scalpel blades) properly.
5. When the sharp item container is full, exchange it for a new one.
6. Dispose of syringes and empty pharmaceutical bottles.
7. Properly clean the area.

Cattle Receiving/ Shipping Procedures

Objective: To ensure that all cattle received/ shipped are healthy and all cattle sold are shipped with complete health records.

5.1 Cattle Receiving

1. If possible, obtain previous health histories of all incoming cattle including treatments, implants, and vaccinations.
2. Inspect and record the health and condition of all incoming cattle.

5.1A Cattle Processing

1. Individually identify all cattle (i.e. brand, ear notch, ear tag, etc.).
2. Administer appropriate vaccine or parasiticide.
3. After processing, record all processing details.

5.1B Handling Sick Cattle

1. Check pastures and facilities daily for sick cattle.
2. Treat the animal accordingly.
3. After treating the animal, identify it appropriately so that this form of identification designates that the animal has been treated.
4. Record all treatments.

5.1C Non-Ambulartory (Downer) Cattle

1. A prompt diagnosis should be made to determine whether the animal should be humanely euthanized or receive additional care.
2. Provide feed and water to non-ambulatory cattle at least once daily.
3. Move downer animals very carefully to avoid compromising animal welfare. Dragging downer animals is unacceptable. Acceptable methods of transporting downers include a sled, low-boy trailer or in the bucket of a loader. Animals should be humanely rolled into the bucket by caretakers.
4. When treatment is attempted, cattle unable to sit up unaided and refuse to eat or drink should be humanely euthanized within 24-36 hours of initial onset.

Transporting Cattle

Objective: To ensure that all cattle transported off the farm/ranch are kept safe and healthy.

6.1 Loading/Unloading cattle

1. When unloading/loading cattle for transport, the handlers will use paddles or sorting sticks to move the cattle.
2. In an emergency situation, for safety reasons, an electric prod may be used, only if all other options have been exhausted.
3. We utilize trailers that allow for access points to the cattle, which makes it easier to move the cattle off of the trailer.
4. Loading dates will be modified based on extreme weather, when applicable.

6.2 Documentation and Required Forms

1. Each truck is equipped with a trucking manual that includes appropriate licensing documents as well as emergency numbers to contact.
2. Each truck driver is required to complete a driver's log (per DOT regulations) for loads hauled and truck/trucker activity.
3. Each truck driver is required to complete a trucking envelope that includes mileage readings, route traveled, commodity hauled and date of load.

6.3 Hiring practices

1. When hiring for a truck driving position, we require each application to provide a copy of their CDL and a health card.
2. We also require (per DOT regulation) each driver, prior to employment, to complete a drug screening. We also participate in random drug screens of our truck drivers.

Feedstuff Receiving, Storage, and Feeding Procedures

Objective: To ensure the proper receiving, storage, handling, and feeding of all feedstuffs and to keep accurate feeding records.

7.1 Feedstuff Receiving

1. Do not purchase or feed ruminant-derived protein sources. These include meat and bone meal or any other products produced from ruminant muscle or bone tissue.
2. When feed or supplements are received, retain purchasing documentation.
3. Inspect incoming feedstuffs on arrival for possible signs of contamination (discoloration, insects, mold, moisture, odor, etc.).
4. Return any feedstuffs that appear to be contaminated.

7.2 Feedstuff Storage and Feeding

1. Store all feeds in their designated areas.
2. Keep feed storage facilities dry, clean, and free of contaminants.
3. Inspect all feed equipment, including scales, mixers, bins, trucks, feed bunks, and feeders regularly.
4. Clean and repair all feed equipment when necessary to ensure proper functioning and to avoid unsafe feed contamination.
5. When mixing feed, follow the rations components and amounts designated.

Pesticides and Fertilizer Procedures

Objective: To ensure the proper storage, handling, and application of pesticides (which include parasiticides, insecticides, herbicides, and fungicides) and fertilizers.

8.1 Pesticide Receiving

1. Purchase only pesticides that are EPA approved.

8.2 Pesticide Storage

1. Store all pesticides if any in designated areas.
2. Ensure that storage facilities are kept clean, dry, well-ventilated, and locked.
3. Clean up all spills immediately.

8.3 Pesticide Use and Record Keeping

1. Use parasiticides on animals that are labeled for animal use.
2. When applying paraciticides to animals, follow label directions.

8.4 Fertilizer Storage, Use, and Record Keeping

1. Store all fertilizer if any in designated areas.
2. Ensure that storage facilities are kept clean, dry, well-ventilated.
3. Keep all fertilizer away from feedstuffs at all times.
4. Clean up all spills immediately.

Record Keeping Procedures

Objective: To ensure that all records are properly maintained and easily accessible.

10.1 Record Keeping

1. Keep all records for three years after the animal's release from the premises.

2. Upon request send a copy of all the health records (includes processing and vaccination records, and medicated feed additives records) with all animals as they leave.

3. Records should be kept available and be easily accessible.

Code Of Cattle Care Handbook Acknowledgement

I have received the Code of Cattle Care from _____ of Cross Four Ranch. I have reviewed the code and agree to raise cattle according to them. I also agree that Cross Four Ranch may visit my operation to confirm compliance with this code.

Producer Name: _____

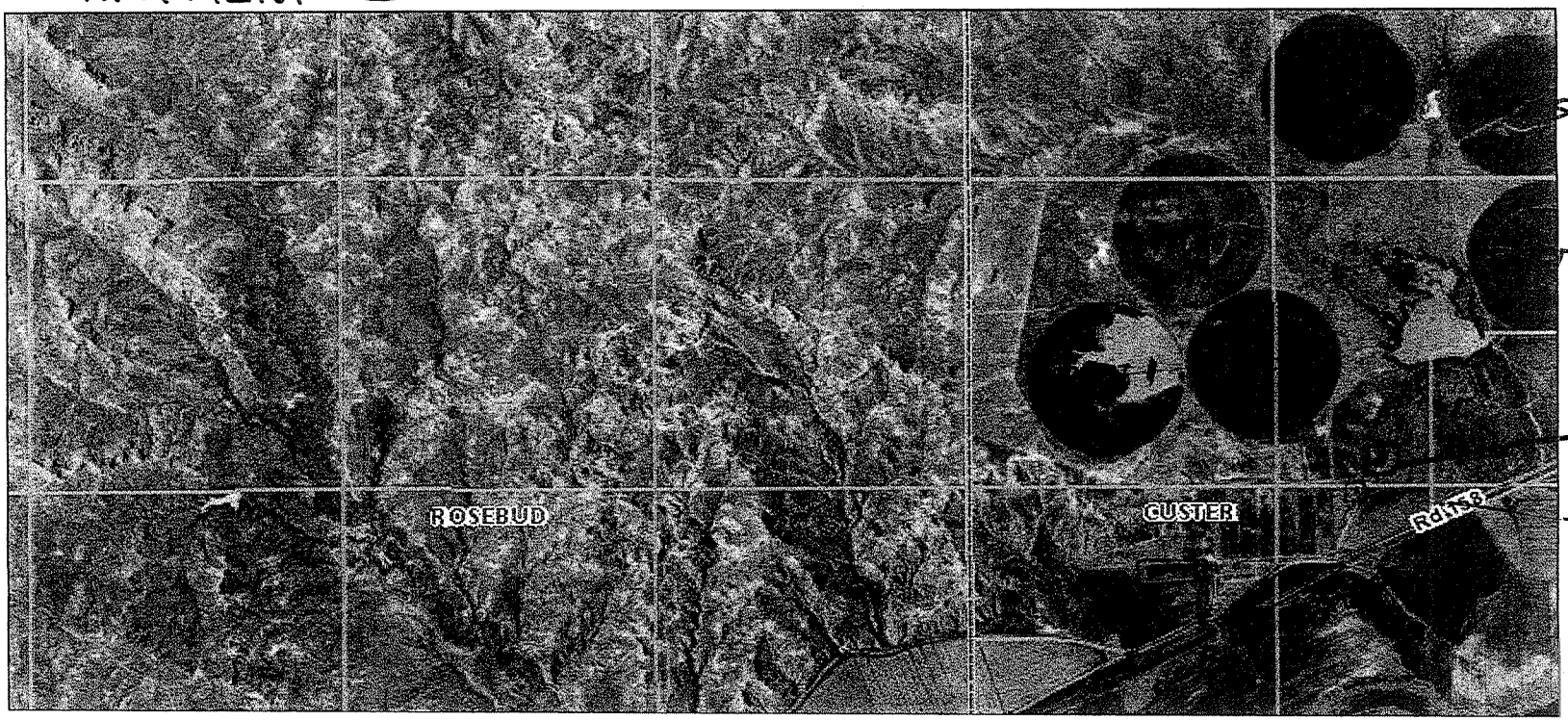
Producer Address: _____

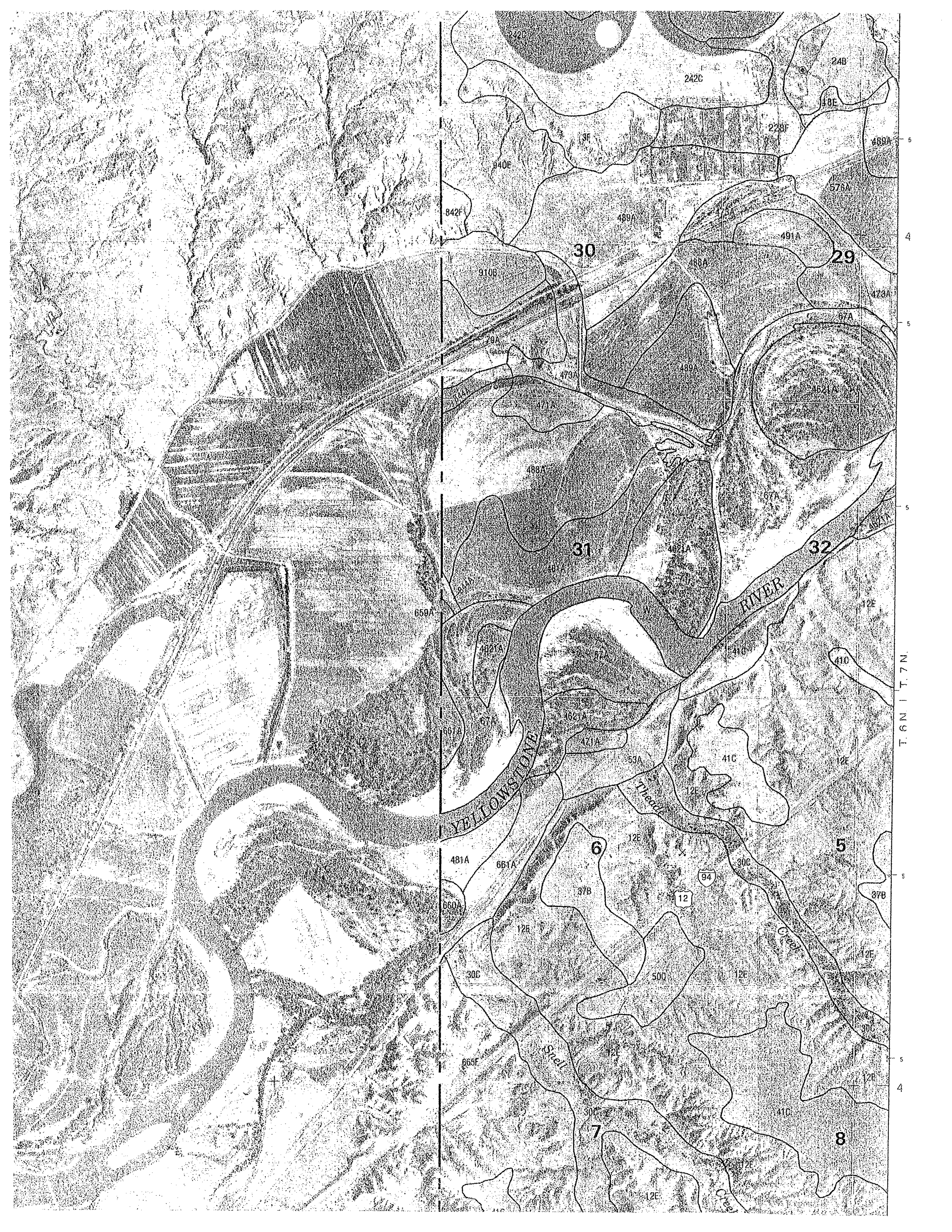
City/State/ZIP: _____

Producer Signature: _____

Date: _____

ATTACHMENT C





242C
242C
24B
18E
229F
3E
940E
489A
842F
489A
576A
473A
491A
30
29
910B
488A
473A
67A
79A
479A
489A
4621A
471A
488A
67A
31
481A
4621A
32
RIVER
659A
W
12E
4621A
67A
41C
41C
T. 6N | T. 7N.
661A
4621A
471A
53A
41C
12E
YELLOWSTONE
Theade
12E
6
12E
5
481A
661A
94
12
30C
37B
37B
660A
12E
Creek
12E
30C
50C
12E
30C
665F
Snell
12E
12E
30C
41C
7
8
12E
12E
41C

Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.1 inches

964E—Cambeth, calcareous-Cabbart-Yawdim complex, 4 to 25 percent slopes

Setting

Landform:
- Cambeth—Sedimentary plains
- Cabbart—Hills
- Yawdim—Sedimentary plains

Position on landform:
- Cambeth—Backslopes and footslopes
- Cabbart—Backslopes and shoulders
- Yawdim—Backslopes and shoulders

Slope:
- Cambeth—4 to 15 percent
- Cabbart—4 to 25 percent
- Yawdim—4 to 15 percent

Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Cambeth and similar soils: 40 percent
Cabbart and similar soils: 25 percent
Yawdim and similar soils: 20 percent

Minor Components

Areas of rock outcrop: 0 to 5 percent
Abor and similar soils: 0 to 5 percent
Lonna and similar soils: 0 to 5 percent

Major Component Description

Cambeth

Surface layer texture: Silt loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, silty sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.0 inches

Cabbart

Surface layer texture: Silt loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, loamy sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 3.0 inches

Yawdim

Surface layer texture: Silty clay loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.4 inches

228F—Cambeth, noncalcareous-Lilsheep-Lonna complex, 15 to 45 percent slopes

Setting

Landform:
- Cambeth—Hills
- Lilsheep—Relict stream terraces
- Lonna—Hills

Position on landform:
- Cambeth—Backslopes and shoulders
- Lilsheep—Shoulders and summits
- Lonna—Backslopes

Slope:
- Cambeth—15 to 45 percent
- Lilsheep—15 to 45 percent
- Lonna—15 to 25 percent

Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Cambeth and similar soils: 40 percent
Lilsheep and similar soils: 25 percent
Lonna and similar soils: 20 percent

Minor Components

Floweree and similar soils: 0 to 5 percent
Cabbart and similar soils: 0 to 5 percent
Soils that have slopes less than 15 percent: 0 to 5 percent

illock
irface layer texture: Clay loam
epth class: Moderately deep (20 to 40 inches)
rainage class: Well drained
ominant parent material: Interbedded sandstone and ale residuum
ative plant cover type: Rangeland
ooding: None
lt affected: Saline within 30 inches
odium affected: Sodic within 30 inches
vailable water capacity: Mainly 4.0 inches

05D—Cabbart-Cambeth silt loams, 8 to 15 percent slopes

Setting

ndform:
Cabbart—Sedimentary plains
Cambeth—Sedimentary plains
osition on landform:
Cabbart—Shoulders and summits
Cambeth—Backslopes
ope:
Cabbart—8 to 15 percent
Cambeth—8 to 15 percent
evation: 2,240 to 2,900 feet
ean annual precipitation: 11 to 14 inches
ost-free period: 110 to 135 days

Composition

ajor Components

Cabbart and similar soils: 50 percent
Cambeth and similar soils: 35 percent

inor Components

Yamacall and similar soils: 0 to 4 percent
Yawdim and similar soils: 0 to 4 percent
Twilight and similar soils: 0 to 4 percent
Soils that have slopes less than 8 percent: 0 to 3 percent

Major Component Description

abbart

urface layer texture: Silt loam
epth class: Shallow (10 to 20 inches)
rainage class: Well drained
ominant parent material: Semiconsolidated, loamy edimentary beds
ative plant cover type: Rangeland
ooding: None
vailable water capacity: Mainly 2.2 inches

Cambeth
Surface layer texture: Silt loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, silty sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 6.6 inches

18E—Cabbart-Havre complex, 0 to 35 percent slopes

Setting

Landform:
- Cabbart—Sedimentary plains
- Havre—Flood plains

Slope:
- Cabbart—2 to 35 percent
- Havre—0 to 2 percent

Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Cabbart and similar soils: 50 percent
Havre and similar soils: 20 percent

Minor Components

Areas of rock outcrop: 0 to 3 percent
Bigsandy and similar soils: 0 to 2 percent
Glendive and similar soils: 0 to 2 percent
Glendive, saline and similar soils: 0 to 2 percent
Harlake and similar soils: 0 to 2 percent
Kobase and similar soils: 0 to 2 percent
Yamacall and similar soils: 0 to 2 percent

Major Component Description

Cabbart

Surface layer texture: Loam
Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated, loamy sedimentary beds
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 2.6 inches

Havre
Surface layer texture: Loam

Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 6.7 inches

24B—Davidell silty clay loam, 0 to 4 percent slopes

Setting

Landform: Sedimentary plains
Slope: 0 to 4 percent
Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Davidell and similar soils: 85 percent

Minor Components

Ivanell and similar soils: 0 to 4 percent
Gerdrum and similar soils: 0 to 4 percent
Sonnett and similar soils: 0 to 4 percent
Soils that have slopes more than 4 percent: 0 to 3 percent

Major Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 6.5 inches

241B—Davidell-Antwerp silty clay loams, 0 to 4 percent slopes

Setting

Landform:
- Davidell—Sedimentary plains
- Antwerp—Sedimentary plains

Position on landform:
- Davidell—Microhighs
- Antwerp—Microlows

Slope:
- Davidell—0 to 4 percent
- Antwerp—0 to 4 percent

Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Davidell and similar soils: 65 percent
Antwerp and similar soils: 20 percent

Minor Components

Kobase and similar soils: 0 to 3 percent
Ivanell and similar soils: 0 to 3 percent
Cambeth and similar soils: 0 to 3 percent
Archin and similar soils: 0 to 3 percent
Sonnett and similar soils: 0 to 3 percent

Major Component Description

Davidell

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 6.5 inches

Antwerp

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 7.0 inches

242C—Davidell-Ivanell complex, 2 to 8 percent slopes

Setting

Landform:
- Davidell—Sedimentary plains
- Ivanell—Sedimentary plains

Slope:
- Davidell—2 to 8 percent
- Ivanell—2 to 8 percent

Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Davidell and similar soils: 40 percent
Ivanell and similar soils: 40 percent

Minor Components

Cambeth and similar soils: 0 to 3 percent
Antwerp and similar soils: 0 to 3 percent
Kobase and similar soils: 0 to 3 percent
Megonot and similar soils: 0 to 3 percent
Sonnett and similar soils: 0 to 3 percent

Major Component Description

Davidell
Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 6.5 inches

Ivanell
Surface layer texture: Silt loam
Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Dominant parent material: Semiconsolidated shale residuum
Native plant cover type: Rangeland
Flooding: None
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 5.1 inches

Degrand Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate over rapid
Landform: Relict stream terraces
Parent material: alluvium
Slope range: 0 to 8 percent
Elevation range: 2,240 to 2,900 feet
Annual precipitation: 11 to 14 inches
Annual air temperature: 43 to 45 degrees F
Frost-free period: 110 to 135 days

Taxonomic Class: Fine-loamy over sandy or sandy-skeletal, mixed Aridic Argiborolls

Typical Pedon
Degrand loam, 0 to 4 percent slopes, in an area of rangeland; 300 feet east and 400 feet north of southwest corner of sec. 14, T. 9 N., R. 48 E.

A—0 to 7 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure parting to moderate very fine and fine granular structure; soft, very friable, slightly sticky and slightly plastic; common medium and fine roots; slightly alkaline; clear smooth boundary.

Bt—7 to 16 inches; grayish brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, sticky and plastic; common medium and fine roots; common medium and coarse tubular pores; few distinct very dark grayish brown (10YR 3/2), moist, clay films on faces of peds and in pores; moderately alkaline; clear smooth boundary.

Bk1—16 to 25 inches; pale brown (10YR 6/3) loam, dark grayish brown (10YR 4/2) moist; moderate medium and coarse subangular blocky structure parting to moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common medium and coarse tubular pores; common medium irregular masses of lime; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk2—25 to 31 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common medium to very fine tubular pores; common medium irregular masses of lime; violently effervescent; moderately alkaline; abrupt smooth boundary.

2C—31 to 60 inches; pale brown (10YR 6/3) sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky and nonplastic; common fine and very fine roots; slightly effervescent; moderately alkaline.

Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Available water capacity: Mainly 9.8 inches

659A—Glendive loam, 0 to 2 percent slopes, occasionally flooded

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Glendive and similar soils: 85 percent

Minor Components

Havre and similar soils: 0 to 10 percent
Hanly and similar soils: 0 to 5 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Forest land
Flooding: Occasional
Available water capacity: Mainly 8.0 inches

452A—Glendive loam, 0 to 2 percent slopes, rarely flooded

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Glendive and similar soils: 85 percent

Minor Components

Havre and similar soils: 0 to 3 percent
Harlake and similar soils: 0 to 3 percent
Hanly and similar soils: 0 to 3 percent
Ryell and similar soils: 0 to 3 percent
Poorly drained soils: 0 to 3 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Available water capacity: Mainly 10.0 inches

486A—Glendive-Havre complex, 0 to 2 percent slopes, nonflooded

Setting

Landform:
- Glendive—Stream terraces
- Havre—Stream terraces

Slope:
- Glendive—0 to 2 percent
- Havre—0 to 2 percent

Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Glendive and similar soils: 50 percent
Havre and similar soils: 40 percent

Minor Components

Harlake and similar soils: 0 to 5 percent
Hanly and similar soils: 0 to 5 percent

Major Component Description

Glendive

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland

Major Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Occasional
Available water capacity: Mainly 9.6 inches

471A—Harlake silty clay, 0 to 2 percent slopes, occasionally flooded

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Harlake and similar soils: 85 percent

Minor Components

Havre and similar soils: 0 to 3 percent
Glendive and similar soils: 0 to 3 percent
Saline soils: 0 to 3 percent
Frequently flooded soils: 0 to 3 percent
Poorly drained soils: 0 to 3 percent

Major Component Description

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Occasional
Available water capacity: Mainly 9.6 inches

47A—Harlake silty clay, 0 to 2 percent slopes, rarely flooded

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Harlake and similar soils: 85 percent

Minor Components

Havre and similar soils: 0 to 3 percent
Saline soils: 0 to 3 percent
Sodic soils: 0 to 3 percent
Soils that have slopes more than 2 percent: 0 to 3 percent
Poorly drained soils: 0 to 3 percent

Major Component Description

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Available water capacity: Mainly 9.0 inches

Havre Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Flood plains and stream terraces
Parent material: Alluvium
Slope range: 0 to 2 percent
Elevation range: 2,240 to 2,700 feet
Annual precipitation: 11 to 14 inches
Annual air temperature: 43 to 45 degrees F
Frost-free period: 110 to 135 days

Taxonomic Class: Fine-loamy, mixed (calcareous), frigid Aridic Ustifluvents

Typical Pedon
Havre loam, 0 to 2 percent slopes, occasionally flooded, in an area of rangeland; 2,400 feet south and 1,500 feet west of the northeast corner of sec. 4, T. 7 N., R. 47 E.

A—0 to 9 inches; brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure parting to moderate medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common medium, fine, and very fine roots; slightly

effervescent; slightly alkaline; clear wavy boundary.

C1—9 to 18 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak coarse prismatic structure; slightly hard, very friable, slightly sticky and slightly plastic; common medium, fine, and very fine roots; common fine and very fine pores; strongly effervescent; moderately alkaline; gradual smooth boundary.

C2—18 to 60 inches; pale brown (10YR 6/3) loam consisting of thin strata of very fine sandy loam; brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common medium, fine, and very fine roots; common fine and very fine pores; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil temperature: 40 to 47 degrees F
Moisture control section: Between 4 and 12 inches; dry in all parts between four-tenths and five-tenths of the cumulative days per year when the soil temperature at a depth of 20 inches is 41 degrees F or higher
Soil phases: Frequently flooded, rarely flooded, occasionally flooded, nonflooded, or channeled

A horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam, silty clay loam, or silty clay
Clay content: 10 to 55 percent
Reaction: pH 6.1 to 8.4

C horizons
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam consisting of thin strata of very fine sandy loam
Clay content: 18 to 35 percent
Reaction: pH 7.4 to 9.0

456A—Havre and Glendive soils, channeled, 0 to 2 percent slopes, frequently flooded

Setting

Landform:
- Havre—Flood plains
- Glendive—Flood plains

Slope:
- Havre—0 to 2 percent
- Glendive—0 to 2 percent

Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Havre and similar soils: 45 percent
Glendive and similar soils: 45 percent

Minor Components

Harlake and similar soils: 0 to 2 percent
Hanly and similar soils: 0 to 2 percent
Nonflooded soils: 0 to 2 percent
Occasionally flooded soils: 0 to 2 percent
Poorly drained soils: 0 to 2 percent

Major Component Description

Havre

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Frequent
Available water capacity: Mainly 9.8 inches

Glendive

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Frequent
Available water capacity: Mainly 10.0 inches

481A—Havre loam, 0 to 2 percent slopes, occasionally flooded

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Havre and similar soils: 85 percent

Minor Components

Harlake and similar soils: 0 to 4 percent
Glendive and similar soils: 0 to 4 percent
Frequently flooded soils: 0 to 4 percent
Poorly drained soils: 0 to 3 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Forest land
Flooding: Occasional
Available water capacity: Mainly 9.8 inches

4881A—Havre loam, 0 to 2 percent slopes, rarely flooded

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Havre and similar soils: 85 percent

Minor Components

Glendive and similar soils: 0 to 3 percent
Harlake and similar soils: 0 to 3 percent
Saline soils: 0 to 3 percent
Soils that have slopes more than 2 percent: 0 to 3 percent
Poorly drained soils: 0 to 3 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Rare
Available water capacity: Mainly 9.8 inches

488A—Havre silty clay loam, 0 to 2 percent slopes, occasionally flooded

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Havre and similar soils: 85 percent

Minor Components

Glendive and similar soils: 0 to 3 percent
Havre loam: 0 to 3 percent
Saline soils: 0 to 3 percent
Frequently flooded soils: 0 to 3 percent
Poorly drained soils: 0 to 3 percent

Major Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Occasional
Available water capacity: Mainly 9.6 inches

661A—Havre silty clay loam, saline, 0 to 2 percent slopes, frequently flooded

Setting

Landform: Flood plains
Slope: 0 to 2 percent
Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Havre and similar soils: 85 percent

he cumulative days per year when the soil
ıperature at a depth of 20 inches is 41 degrees F
ıigher
pth to water table: 42 to 60 inches

ıorizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Clay content: 27 to 40 percent
Electrical conductivity: 2 to 8
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.4 to 8.4

horizon
Value: 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Silt loam, silty clay loam, or loam
Clay content: 18 to 35 percent
Electrical conductivity: 8 to 16 mmhos/cm
Sodium absorption ratio: 13 to 20
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.9 to 9.0

horizon
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 3 or 4
Texture: Very fine sandy loam, loam, silty clay loam, or clay loam
Clay content: 18 to 35 percent
Electrical conductivity: 4 to 16 mmhos/cm
Sodium absorption ratio: 10 to 35
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.9 to 9.0

horizon
Hue: 2.5Y or 10YR
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4
Texture: Loam, silty clay loam, or clay loam
Clay content: 18 to 35 percent
Electrical conductivity: 4 to 16 mmhos/cm
Sodium absorption ratio: 5 to 35
Calcium carbonate equivalent: 5 to 10 percent
Reaction: pH 7.9 to 9.0

11A—Ismay silty clay loam, 0 to 2 percent slopes, occasionally flooded

Setting

ndform: Flood plains
ɔpe: 0 to 2 percent
Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Ismay and similar soils: 85 percent

Minor Components

Havre and similar soils: 0 to 3 percent
Glendive and similar soils: 0 to 3 percent
Frequently flooded soils: 0 to 3 percent
Soils that have slopes more than 2 percent: 0 to 3 percent
Poorly drained soils: 0 to 3 percent

Major Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: Occasional
Water table: Apparent
Salt affected: Saline within 30 inches
Sodium affected: Sodic within 30 inches
Available water capacity: Mainly 7.6 inches

Ivanell Series

Depth class: Moderately deep
Drainage class: Well drained
Permeability: Moderately slow
Landform: Sedimentary plains
Parent material: Semiconsolidated shale residuum
Slope range: 2 to 8 percent
Elevation range: 2,240 to 2,900 feet
Annual precipitation: 11 to 14 inches
Annual air temperature: 43 to 45 degrees F
Frost-free period: 110 to 135 days

Taxonomic Class: Fine-silty, mixed Typic Eutroboralfs

Typical Pedon
Ivanell silt loam in an area of Davidell-Ivanell complex, 2 to 8 percent slopes, in an area of rangeland; 2,000 feet north and 1,500 feet east of the southwest corner of sec. 25, T. 10 N., R. 47 E.

E—0 to 3 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium granular structure; soft,

Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 5.8 inches

Lallie Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Slow
Landform: Oxbows
Parent material: Alluvium
Slope range: 0 to 2 percent
Elevation range: 2,240 to 2,700 feet
Annual precipitation: 11 to 14 inches
Annual air temperature: 43 to 45 degrees F
Frost-free period: 110 to 135 days

Taxonomic Class: Fine, montmorillonitic (calcareous), frigid Vertic Fluvaquents

Typical Pedon
Lallie silty clay, 0 to 2 percent slopes, in an area of rangeland; 2,400 feet north and 1,200 feet east of the southwest corner of sec. 4, T. 7 N., R. 47 E.

A1—0 to 6 inches; light brownish gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; very hard, firm, sticky and plastic; common fine and very fine roots; slightly effervescent; slightly alkaline; abrupt smooth boundary.

A2—6 to 9 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; very hard, firm, sticky and plastic; common fine and very fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.

Cg1—9 to 37 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; common medium and coarse prominent light olive brown (2.5Y 5/6) moist redox concentrations; massive; very hard, firm, sticky and plastic; common very fine roots; common very fine pores; slightly effervescent; slightly alkaline; gradual wavy boundary.

Cg2—37 to 53 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; common medium and coarse distinct light olive brown (2.5Y 5/6) moist redox concentrations; massive; very hard, firm, sticky and plastic; common very fine roots; common very fine pores; slightly effervescent; slightly alkaline; gradual wavy boundary.

Cg3—53 to 60 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; common coarse distinct light olive brown (2.5Y 5/6) moist redox concentrations, common faint olive (5Y 4/3) moist redox concentrations; massive; very hard, firm, sticky and plastic; common very fine roots; slightly effervescent; slightly alkaline.

Range in Characteristics

Soil temperature: 42 to 47 degrees F
Depth to water table: 6 to 12 inches

A horizons
Hue: 10YR or 5Y
Value: 3 to 6 dry; 2 or 4 moist
Chroma: 1 or 2
Clay content: 40 to 60 percent
Reaction: pH 6.6 to 7.8

Cg horizons
Hue: 2.5Y or 10YR
Value: 4 or 8 dry; 3 to 6 moist
Chroma: 1 or 2
Texture: Silty clay loam or silty clay
Clay content: 35 to 60 percent
Reaction: pH 7.4 to 9.0

473A—Lallie silty clay, 0 to 2 percent slopes

Setting

Landform: Oxbows
Slope: 0 to 2 percent
Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Lallie and similar soils: 85 percent

Minor Components

Havre and similar soils: 0 to 4 percent
Harlake and similar soils: 0 to 4 percent
Nonflooded soils: 0 to 4 percent
Saline soils: 0 to 3 percent

Major Component Description

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained

Bk1 horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Silt loam or silty clay loam
Clay content: 18 to 35 percent
Sodium absorption ratio: 1 to 13
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 9.0

Bk2 horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Silt loam or silty clay loam
Clay content: 10 to 35 percent
Sodium absorption ratio: 10 to 20
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 9.0

57A—Lonna silt loam, 0 to 2 percent slopes

Setting

Landform: Sedimentary plains
Slope: 0 to 2 percent
Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Lonna and similar soils: 85 percent

Minor Components

Cambeth and similar soils: 0 to 3 percent
Floweree and similar soils: 0 to 3 percent
Alona and similar soils: 0 to 3 percent
Poorly drained soils: 0 to 3 percent
Soils that have slopes more than 2 percent: 0 to 3 percent

Major Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.3 inches

57C—Lonna silt loam, 2 to 8 percent slopes

Setting

Landform: Sedimentary plains
Slope: 2 to 8 percent
Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Lonna and similar soils: 85 percent

Minor Components

Cambeth and similar soils: 0 to 3 percent
Floweree and similar soils: 0 to 3 percent
Kobase and similar soils: 0 to 3 percent
Alona and similar soils: 0 to 3 percent
Soils that have slopes more than 8 percent: 0 to 3 percent

Major Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.3 inches

576A—Lonna silty clay loam, 0 to 2 percent slopes

Setting

Landform: Sedimentary plains
Slope: 0 to 2 percent
Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Lonna and similar soils: 85 percent

Minor Components

Lonna silt loam: 0 to 4 percent
Kobase and similar soils: 0 to 4 percent

62A—Marvan silty clay, 0 to 2 percent slopes

Setting

Landform: Sedimentary plains
Slope: 0 to 2 percent
Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Marvan and similar soils: 85 percent

Minor Components

Vanda and similar soils: 0 to 3 percent
Megonot and similar soils: 0 to 3 percent
Kobase and similar soils: 0 to 3 percent
Poorly drained soils: 0 to 3 percent
Soils that have slopes more than 2 percent: 0 to 3 percent

Major Component Description

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.7 inches

62C—Marvan silty clay, 2 to 8 percent slopes

Setting

Landform: Sedimentary plains
Slope: 2 to 8 percent
Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Marvan and similar soils: 85 percent

Minor Components

Megonot and similar soils: 0 to 4 percent
Kobase and similar soils: 0 to 4 percent
Soils that have slopes more than 8 percent: 0 to 3 percent
Vanda and similar soils: 0 to 2 percent
Soils that have slopes less than 2 percent: 0 to 2 percent

Major Component Description

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.7 inches

621B—Marvan-Vanda silty clays, 0 to 4 percent slopes

Setting

Landform:
- Marvan—Sedimentary plains
- Vanda—Sedimentary plains

Slope:
- Marvan—0 to 4 percent
- Vanda—0 to 4 percent

Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Marvan and similar soils: 50 percent
Vanda and similar soils: 35 percent

Minor Components

Marias and similar soils: 0 to 4 percent
Kobase and similar soils: 0 to 4 percent
Benz and similar soils: 0 to 4 percent
Poorly drained soils: 0 to 3 percent

Major Component Description

Marvan

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 7.7 inches

Texture: Loam, clay loam, or silty clay loam
Clay content: 18 to 35 percent
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 8.4

2BC horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam or clay loam
Clay content: 18 to 30 percent
Reaction: pH 7.9 to 8.4

2C horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 or 3
Texture: Loam or clay loam
Clay content: 18 to 30 percent
Reaction: pH 7.9 to 8.4

489A—Spinekop silty clay loam, 0 to 2 percent slopes

Setting

Landform: Stream terraces
Slope: 0 to 2 percent
Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Spinekop and similar soils: 85 percent

Minor Components

Yamacall and similar soils: 0 to 4 percent
Kobase and similar soils: 0 to 4 percent
Marias and similar soils: 0 to 4 percent
Soils that have slopes more than 2 percent: 0 to 3 percent

Major Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 10.1 inches

Tally Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Sedimentary plains
Parent material: Alluvium or eolian material
Slope range: 2 to 12 percent
Elevation range: 2,900 to 3,760 feet
Annual precipitation: 15 to 17 inches
Annual air temperature: 43 to 45 degrees F
Frost-free period: 110 to 135 days

Taxonomic Class: Coarse-loamy, mixed Typic Haploborolls

Typical Pedon
Tally fine sandy loam in an area of Tally-Vebar fine sandy loams, 2 to 12 percent slopes, in an area of rangeland; 2,300 feet south and 2,300 feet east of northwest corner of sec. 16, T. 1 N., R. 46 E.

A—0 to 4 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common fine and very fine roots; slightly alkaline; clear smooth boundary.

Bw1—4 to 9 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine and very fine roots; common fine and very fine pores; slightly alkaline; gradual wavy boundary.

Bw2—9 to 16 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine roots; common very fine pores; slightly effervescent; slightly alkaline; clear smooth boundary.

Bk1—16 to 32 inches; very pale brown (10YR 7/4) fine sandy loam, yellowish brown (10YR 5/4) moist; moderate coarse prismatic structure; hard,

Bw horizon
Hue: 10YR or 2.5Y
Value: 5 or 6 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam or silt loam
Clay content: 18 to 27 percent
Reaction: pH 6.6 to 8.4

Bk horizons
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Texture: Loam or silt loam
Clay content: 18 to 27 percent
Calcium carbonate equivalent: 5 to 15 percent
Reaction: pH 7.9 to 8.4

BC horizon
Hue: 10YR or 2.5Y
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4
Clay content: 18 to 27 percent
Reaction: pH 7.9 to 9.0

79A—Yamacall loam, 0 to 2 percent slopes

Setting

Landform: Sedimentary plains
Slope: 0 to 2 percent
Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Yamacall and similar soils: 85 percent

Minor Components

Busby and similar soils: 0 to 4 percent
Kobase and similar soils: 0 to 3 percent
Lonna and similar soils: 0 to 3 percent
Soils that have slopes more than 2 percent: 0 to 3 percent
Poorly drained soils: 0 to 2 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.7 inches

79C—Yamacall loam, 2 to 8 percent slopes

Setting

Landform: Sedimentary plains
Slope: 2 to 8 percent
Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Yamacall and similar soils: 85 percent

Minor Components

Delpoint and similar soils: 0 to 3 percent
Busby and similar soils: 0 to 3 percent
Kobase and similar soils: 0 to 3 percent
Lonna and similar soils: 0 to 3 percent
Soils that have slopes more than 8 percent: 0 to 3 percent

Major Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Dominant parent material: Alluvium
Native plant cover type: Rangeland
Flooding: None
Available water capacity: Mainly 9.7 inches

79D—Yamacall loam, 8 to 15 percent slopes

Setting

Landform: Sedimentary plains
Slope: 8 to 15 percent
Elevation: 2,240 to 2,900 feet
Mean annual precipitation: 11 to 14 inches
Frost-free period: 110 to 135 days

Composition

Major Components

Yamacall and similar soils: 85 percent